Forest Vegetation Monitoring

Introduction

Ninety- five percent of Shenandoah National Park is forested with Eastern deciduous woodlands. These forests of oak- hickory, cove hardwood, and tulip poplar trees are a key component of the ecological foundation of the park, and the matrix within which many aspects of park operations take place. Long- term monitoring of Park forests began in 1989 and continues today as a way to document the status of the forest and detect large- scale changes resulting from human- caused or natural environmental factors.

Management Needs

Long- term forest monitoring is being done to provide information on how the forests of the park are changing over time. Many factors such as gypsy moth, hemlock wooly adelgid, invasive exotic plants, storms, and other disturbances are constantly impacting our forests. Long-term forest monitoring allows us to describe the forest's composition, and then quantify the way the forest composition and regeneration respond to disturbance. Monitoring forests over time also provides early warnings of new forest threats such as new invasive plants, animals, and diseases. The fire fuels monitoring included with the forest monitoring program also aids the fire program by providing information used in fire behavior models critical to making proper decisions when fighting wildfire.

Indentifing and counting plants in sub-plots.

History and Current Procedures

The park's long- term forest monitoring program ran from 1989- 1999 using the original protocol developed by foresters and statisticians at Virginia Tech University (Smith and Torbert, 1991). After these initial 10 years, weaknesses in the program (Gibbs, 1998 ;Oderwald, 1996;1998) prompted a four year peer- reviewed process of evaluation and revision from 1999- 2003 (Mahan, 2000; Diefenbach, 2001; Diefenbach and Mahan, 2002; Diefenbach and Vreeland, 2003). This process served to 1) better define program objectives, 2) evaluate the usefulness of existing data to answer ecological questions, and 3) refine the sampling design. Throughout this process, existing forest monitoring data were used to determine the statistical strengths and weaknesses of the program. The shortcomings were then addressed through program changes including a streamlined protocol, a revised plot sampling scheme, and the addition of sampling plots. The process of implementing changes began in 2003, continued in 2004, and will be completed in 2005.

Once the revisions are complete, the program will contain 160 sampling sites distributed throughout the backcountry of the Park according to combinations of elevation, aspect, and bedrock geology. Each sampling site will measure 24 x 24 meters and includes measurements of 1) tree species, diameter, crown health, and crown class; 2) shrub and sapling species, size class, and density; 3) woody seedling species and density; 4) cover class of the five most abundant herbaceous plant species; 5) cover class of ten target exotic species; 6) ground cover; and 7) fire fuels characteristics.

Beginning in 2005, the forest vegetation monitoring program will be active in alternate years as the Park's Natural Resources Monitoring program conserves funds by alternating field crew resources between the aquatic fauna and vegetation monitoring programs.

Park staff placing marking posts in monitoring plot.

What We Have Learned

Data from this program have been used to describe forest changes that have occurred in the park over the last decade. Some examples include:

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1) the documentation of a 40% loss of adult chestnut oak (Quercus prinus) trees following the gypsy moth invasion;

2) the stability of the tulip poplar forests marred only by the 90% loss of dogwood trees to dogwood anthracnose (Discula destructiva);

3) the dramatic reduction in pine trees by pine bark beetles, followed by the establishment of the invasive tree- of-heaven (Ailanthus altisimus) at several former pine sites.

Using a staff compass to layout a monitoring plot.

References

Diefenbach, D.R. 2001. Statistical evaluation of the vegetation inventory and monitoring program at Shenandoah National Park. Final report submitted to National Park Service. Cooperative Agreement No. CA4000- 8- 9028, Supplemental Agreement No. 16.

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Diefenbach, D.R. and J.K. Vreeland 2003. A revised sampling design for vegetation inventory and monitoring at Shenandoah National Park. Final report submitted to National Park Service. Cooperative Agreement No. CA 4000- 08- 9028, Supplemental Agreement No. 29.

Gibbs, J.P. 1998. Integrating Monitoring Objectives with Sound Sampling Design- a pilot review of selected monitoring programs at Shenandoah National Park. Final report submitted to National Park Service.

Mahan, C. 2000. Vegetation inventory and monitoring workshop for Shenandoah National Park: setting objectives and priorities. Summary Report of Workshop Outcomes submitted to National Park Service.

Oderwald, 1998. Characteristics of long term environmental monitoring plots on the Shenandoah National Park. Report submitted to National Park Service.

Oderwald, 1996. Evaluation of LTEM plant community plots. Final report submitted to National Park Service.

Smith and Torbert Smith, D. W. and J. L. Torbert. 1990. Shenandoah National Park long- term ecological monitoring system. Section II. Forest components user manual. NPS/NRSHEN/NRTR- 90/02.

Using measuring tapes to layout a monitoring plot.